The Extent of the Annulus, and the Function of the different Parts of the Sporangium of Ferns in the Dispersion of Spores.*

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A study of the sporangia of the different families of ferns made to determine the character of the so-called "complete annulus" makes it necesary to place some restrictions upon the use of that term as applied to the part of the annulus concerned primarily in the dispersion of the spores.

In the Polypodiaceæ the annulus is said to be "incomplete." It extends from the distal end of the stalk over the dorsum and vertex of the sporangium to the anterior upper angle. The lip cells in the front possess thickened and lignified walls, and between them the line of cleavage occurs at the moment of dehiscence. Between the upper lip cell and the anterior end of the annulus are two or three cells with walls exactly like those of the lateral walls of the sporangium. Similar cells also exist between the lower lip cell and the distal end of the stalk at the lower angle of the sporangium. These cells serve as connectives between the lip cells and the anterior end of the annulus on the one hand and the stalk on the other. At the moment of dehiscence they serve as a pull upon the lip cells as the annulus is everting. The lip cells being situated at the middle of the front divide the sporangium in halves and the line of cleavage started continues straight across the lateral walls of the sporangium. The connectives serve also another very important function. They are passive like the lateral walls and thus the halves of the sporangium remain intact while the annulus is being everted and preparing to spring. By this means the spores are held in place until the annulus springs when they are hurled violently away.

In the Cyatheaceæ, Gleicheniaceæ, and Hymenophyllaceæ the annulus is said to be "complete," *i. e.*, it extends entirely around the sporangium.

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In *Cyathea brunonis* and *Cibotium chamissoi* of the Cyatheaceæ which I have examined, divisions strictly homologous with those pointed put in the Polypodiaceæ are found. The true annulus, *i. e.*, that portion which functions as the spring, extends from the lower anterior angle of the sporangium, backward by the side of the stalk, up the dorsum and over the vertex to the anterior upper angle. A series of four to six lip cells similar in appearance to, but smaller than those of the true annulus, occupies the middle of the front. Between two of these the line of cleavage occurs. An upper and lower connective, each consisting of two or three cells exactly like those of the lateral walls of the sporangium, interrupts the so-called "complete annulus." Sporangia of both these species, which had lain in the herbarium over thirty years, when moistened with water and then dried, or treated with glycerine to extract the water from the cells of the annulus, opened promptly by the everting of the part of the annulus here designated as the true annulus. The spring also occurred with as much snap seemingly as might have taken place at the time of the dehiscence of the sporangium. The entire proceeding could easily be watched under the high power of the microscope, and it was easy to see which part functioned as the spring and which part was passive.

In *Hymenophyllum demissum* and *H. ciliatum* the true annulus occupies a greater portion of the circumference of the sporangium than in the Cyatheaceæ, but it is not complete. The short stalk is attached nearly perpendicular to the sporangium by the side of one end of the annulus. Narrow elongated lip cells are present joined to the annulus by two small connectives, and in dehiscence the sporangium is divided into halves.

In the Gleicheniaceæ as shown by *Gleichenia emarginata* the same divisions are present, but the connectives are quite large and prominent, as shown when a longitudinal section of the annulus is made.

In *Schizæa pusilla* and *Aneimia Phyllitidis* of the Schizæaceæ elongated lip cells and small connectives are present, and the true annulus when seen in side view and in section stands out quite prominently from the other parts of the ring of cells at the summit of the ovate sporangium.

In *Osmunda regalis, cinnamomea,* and *Claytoniana,* and *Todea rivularis* the same parts are present, the true annulus being situated upon the dorsum of the sporangium.

In all these families the sporangium is divided into halves at the time of dehiscence. The true annulus, the connectives and the lip cells perform identical functions in all. Were the annulus in any of them "complete," the highly developed mechanism which now serves the fern so perfectly in the dispersion of the spores would be defeated. During the eversion of a "complete" annulus the lateral walls of the sporangium would be torn to pieces and the spores would fall to the ground before the spring took place, and the present comparatively wide dispersion could not take place.

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Notes Upon a New Exobasidium.*

The genus *Exobasidium* is interesting in standing almost alone as containing parasites in the large group Thelephoreæ of the Hymenomycetous Fungi. Authors have differed as to the place the genus should hold in the classification, but Saccardo ignoring the views of Schroter and others, disposes of it as above stated. He describes eleven species, eight of which according to Farlow's Index are American. Of these only one is upon a host outside of the Heath family, namely, *Exobasidium Symploci,* E. & M. on *Symplocos tinctoria,* L. Her. The American species on Ericaceæ may be tabulated with the hosts as follows:

1. *Exobasidium Vaccinii* (Fl.) Woron.

   On *Arbutus Menziesii, Arctostaphylus Uva-ursi, Cassiope tetragona, Gaylussacia resinosa, Rhododendron viscosum, Vaccinium macrocarpum, Vaccinium uliginosum, Vaccinium Vitis-Idaea.*

2. *Exobasidium Andromedæ,* Pk.

   On *Andromeda ligustrina.*

3. *Exobasidium Azaleæ,* Pk.

   On *Rhododendron nudiflorum.*

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